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ABSTRACT

Research into the problems, causes, and possible solutions to the environmental crisis confronting mankind led to the development of these guidelines for curriculum development by the Interdisciplinary Environmental Education Project of Broward County, Florida. The purpose of the research was to determine the role that could be played by the educational community and to identify those aspects of the problem that should be given major emphasis. This booklet contains Part I of a three-part publication. It is a compilation of the basic concepts upon which the entire program is based. It also includes the major environmental problems with which we are or will be confronted, the alternatives, and the possible solutions to these problems. It is sufficiently general, in scope and content, to be of value to those having responsibility for curriculum development. Parts II and III deal with classroom/outdoor activities and community resources and involvement. This work was prepared under an ESEA Title III contract. (BL)

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PART I

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GUIDELINES FOR CURRICULUM DEVELOPMENT- ENVIRONMENTAL EDUCATION K-12

PART I
Concepts, ideas, objectives and principles

PART II
Classroom and outdoor activities and projects

PART III
Involving the community and its resources

INTERDISCIPLINARY ENVIRONMENTAL EDUCATION
AN ESEA TITLE III PLANNING PROJECT
based at Nova High School
Broward County, Florida

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INTRODUCTION

These guidelines were prepared by the staff of the Interdisciplinary Environmental Education project operating under an ESEA Title III grant. They consist of three parts which are outlined below.

Although Parts II and III pertain to the Broward County area of South Florida, their objectives and the procedures employed in their creation could be replicated in any community. For purposes of dissemination, these guidelines will be made available in three separate parts or combined in one binding. They consist of:

Part I - Concepts, Ideas, Objectives and Principles

This is a compilation of the basic concepts upon which the entire program is based. It also includes the major environmental problems with which we are or will be confronted, the alternatives, and the possible solutions to these problems. It is sufficiently general, in scope and content, to be of great value to anyone having responsibility for curriculum development.

Part II - Classroom and Outdoor Activities

This manual provides detailed descriptions of activities that can be performed by individuals, small groups, and large groups at each grade level and in all subject areas K through 12. In addition to classroom activities, meaningful field experiences available in the Broward County area are fully described. Each activity is designed as a vehicle through which students and teachers can attain stated performance objectives without detracting from the time and effort devoted to the existing curriculum.

Part III - Involving the Community and Its Resources

This is a description of the community resources which can be used in seeking solutions to local environmental problems. It includes a listing and description of civic agencies, individual resource people, commercial establishments, and private organizations that are concerned, directly or indirectly, with environmental issues. It also contains a section on the procedures to follow for obtaining community action on environmental problems.

Though the project staff have addressed their efforts to the problems associated with urban areas, much of the work presented herein is applicable to any community seeking to incorporate environmental education into the school curriculum. The work performed under this grant is highly replicable and has been appropriately evaluated. The guidelines, together with the peripheral and supporting educational aids, constitute a complete K through 12, teacher in-service, and adult community program in environmental education.

The project staff hopes they have presented a viable solution to the problem of including additional and highly relevant areas of study in an already saturated curriculum.

PREFACE

Preliminary planning for this project included research into the problems, causes, and possible solutions to the environmental crisis confronting mankind. The purpose of this research was to determine the role that could be played by the educational community and to identify those aspects of the problem that should be given major emphasis. As a result of this study, several conclusions have been reached. Mainly:

1. Science and technology already have the solutions to almost all the technical problems.

2. Most of these solutions require a change in attitudes and a reappraisal of the priorities people place on the use and distribution of all natural resources.

3. An environmental education program would have greater impact if the major thrust was in the area of humanities rather than in the sciences. Cognitive knowledge of the environment should be stressed where it can provide or support the rationales for attitudinal changes.

Since an objective of this project is to improve curriculum through the inclusion of topics having high relevancy for the student, we should perhaps ask the question, "What is worth learning?"

To answer this question, we must first consider the purpose toward which learning is to be directed. What do we, as individuals, seek to attain for ourselves during the relatively short span of our lives? Toward what goals do all men collectively contribute their eternal efforts? As one progresses through life it becomes apparent that certain goals are indisputably common to all men. The pursuit of happiness, freedom from want, the quest for material possessions that contribute to comfort and security, and the desire for personal freedom, to name a few.

Some of these things are material in nature and can be acquired by learning more about our environment and the resources that can be extracted from it. So we must learn to discover, compute, and communicate, so we can design and build. Some of these things are not likely to be found in material things. They are frequently of the emotions and spirit. There cannot be peace and happiness without unselfishness, nor can we abolish suffering without concern for each other.

So what is worth learning? Anything that contributes to:

1. Man's <u>knowledge</u> of his environment.

2. Man's <u>love</u> for his environment.

. . .however, a point we had better heed--<u>one is worthless without the other</u>.

J.E.A.

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O U T L I N E

I.

BASIC CONCEPTS AND IDEAS

A. All things living and non-living are interrelated.

1. This interdependence must be examined in terms of varieties and similarities.

2. This interdependence must be examined in terms of patterns.

3. This interdependence must be examined in terms of continuity and change.

4. This interdependence must be examined in terms of evolution.

B. All organisms are interrelated through matter and energy.

1. All organisms are interrelated through food relationships.

2. All organisms require energy which is continuously supplied by the sun.

3. All organisms require matter which must be recycled since there is no continuous input.

4. All organisms are interrelated with the non-living or physical part of the environment.

C. The causes and effects of change must be considered.

1. There are causes for changes in the environment.

2. Changes in the environment affect the organisms present.

D. Population size is regulated in nature.

1. External factors regulate population size.

2. Internal factors regulate population size.

E. The world is a finite system with limited resources.

1. Human consumption is the use of natural resources.

2. These resources vary in respect to availability, distribution and renewability.

O U T L I N E

II.

PROBLEMS

A. The environment is contaminated (pollution).

1. Water is polluted.

2. Air is polluted.

3. Land is polluted.

4. The environment in general is polluted.

B. Population growth is uncontrolled.

1. There is a lack of awareness of the effects of overpopulation on the environment.

2. There is a lack of widespread dissemination of family planning information.

C. Resources are mismanaged.

1. Resources are not used efficiently.

2. There is a lack of respect for future needs.

3. There is a lack of consideration for the economic value of the environment.

4. Wildlife and natural areas need to be preserved.

5. There is insufficient land use regulation.

D. Roadblocks prevent the implementation of available technological solutions.

1. Cultural and social roadblocks prevent implementation.

2. Economic and industrial roadblocks prevent implementation.

3. Political roadblocks prevent implementation.

O U T L I N E

III.

SOLUTIONS AND OBJECTIVES

A. Technical solutions and/or controls are available to solve (or at least lessen) the problem of environmental contamination (pollution).

1. Water pollution can be controlled.
2. Air pollution can be controlled.
3. Land use can be managed.
4. Pollution of the environment in general can be reduced.

B. Population growth must be controlled.

1. Develop a public awareness of the effects of overpopulation on the environment.
2. Family planning information should be made available to everyone.

C. Resources can be managed efficiently.

1. Manage the harvesting of renewable resources.
2. Evaluate the use of resources in terms of both present and future needs.
3. Consider the economic value of the environment.
4. Respect wildlife and natural areas as being useful and necessary.
5. Regulate land use with consideration for both man and the environment.

D. Roadblocks can be removed.

1. Individuals must develop an awareness of their environment and assume a personal responsibility for the development of a healthy environment (cultural and social).
2. Economic values must be assigned to environmental resources, when decisions on the economic feasibility of an action involving the environment are to be made (economic and industrial).
3. Procedures must be defined for changing government policy, attitudes, rules, regulations and laws, accompanied by a strict enforcement policy (political).

I.

BASIC CONCEPTS AND IDEAS

A. All things living and non-living are interrelated.

1. This interdependence must be examined in terms of varieties and similarities.

(a) Man is an animal and is bound by the same biological principles as other animals.

(b) There are certain basic elements that make up all living material. These major elements are carbon, hydrogen, oxygen, and nitrogen.

(c) There are characteristic ecosystems, each with unique populations.
EX: A desert ecosystem includes different kinds of organisms than a grassland ecosystem, which includes different kinds of organisms than a forest ecosystem, etc.

(d) All living things require certain necessities. The environment can provide these necessities.
EX: The basic ones are air, earth, and water.

2. This interdependence must be examined in terms of patterns.

(a) Organisms live in communities, each community consisting of an interacting assortment of different kinds of organisms.
EX: A pond community in the midwest might include such a variety of organisms as algae, aquatic insects, bacteria, fish, etc.

(b) The community together with the non-living factors affecting that community comprise an ecosystem.
EX: The pond community mentioned above, together with the water, dissolved gases and minerals, temperature conditions, etc., comprise a pond ecosystem.

(c) The whole earth is actually one big environmental system. There is interaction between ecosystems as well as within ecosystems.
EX: Besides interaction with the pond, there is interaction between the pond and the surrounding woodland. Raccoons eat fish; leaves from trees fall into the pond and make it more fertile; trees provide a windbreak and affect pond temperature.

(A. contd.)

3. This interdependence must be examined in terms of continuity and change.

   (a) All things in the environment are constantly changing.

   (b) In the natural interaction of producers, consumers, and decomposers all matter is recycled, generating no waste. This natural cycle has allowed life on earth to be sustained for millions of years.

   (c) In his technological advancement man has accelerated the use of resources and neglected the recycling process resulting in the depletion of resources and the contaminating of the environment through the buildup of waste materials (pollution).

4. This interdependence must be examined in terms of evolution.

   (a) The long-term evolution of ecosystems is shaped by <u>outside</u> forces such as geologic and climatic changes and <u>inside</u> forces or processes resulting from activities of the living components of the ecosystem.

   (b) A change in the environment influences a change in species.

   (c) Organisms must either adapt to changing environments through the process of natural selection, migrate, or become extinct.

B. <u>All organisms are interrelated through matter and energy</u>.

1. All organisms are interrelated through food relationships.

   (a) Food relationships may be outlined by grouping organisms into levels:

      (1) The <u>producers</u> at the base level are largely green plants.

      (2) The <u>primary consumers</u> are organisms that feed on green plants or producers.

      (3) The <u>secondary consumer</u> feeds on the primary consumer.

      (4) The <u>tertiary consumer</u> feeds on the secondary consumer, and so on.

      (5) The <u>decomposers</u> feed upon the dead organisms from all levels and break down the dead material so that it can be used once again by the green plants (recycled).

      EX: Grass is a producer. A grasshopper feeding on grass is a primary consumer. A frog feeding on the grasshopper is a secondary consumer. A snake feeding on the frog is a tertiary consumer, etc. Bacteria, mold and fungi on the decaying body of a dead snake are decomposers.

(B. contd.)

(b) In a food chain the efficiency of one organism eating another is about 10% for each level.
EX: All material eaten is not utilized and that which is utilized is not utilized efficiently. Much of the energy produced during cellular respiration is lost as heat.

(c) In food chains the inefficient conversion from one step to the next reduces the total biomass (unit volume of living things in a habitat).
EX: As a consequence of inefficient energy transfer, each level (primary consumer, secondary consumer, etc.) has a smaller total biomass than the level below it. For example, 100 pounds of producers may support only 10 pounds of primary consumers which may support only one pound of secondary consumers. The result is a "food pyramid."

(d) The energy lost in the transfer between levels in a food chain is radiated and lost to the system.

(e) The natural situation in food relationships is really more like a web than a chain.
EX: Many consumers feed on several types of food and often at several levels. Food relationships are much more complex than just a simple chain. For example, a snake may feed on both a frog, which is a secondary consumer, and a field mouse which is a primary consumer.

(f) Since only green plants can "produce" and give off oxygen as a by-product of food production, other living organisms could not exist without green plants.

2. All organisms require energy which is continuously supplied by the sun.

(a) Energy from the sun is stored in chemical form. The breaking and combining of chemical bonds results in release of energy used by life.

(b) Energy can neither be created nor destroyed.
EX: It can, however, be changed in form (heat, light, electricity).

(c) Energy is essential for growth, replacement, maintenance and reproduction. Living organisms receive this energy through the breakdown of matter.

(d) The earth receives a constant input of energy from the sun. The part of this energy that is trapped by green plants serves as the basis for life. Since there is a constant input of energy, energy does not need to be recycled for life to continue.

(e) The role of the heating of the earth's crust is important.
EX: Energy from the sun functions in heating the earth.

(B. contd.)

3. All organisms require matter which must be recycled since there is no continuous input.

   (a) Some organisms must obtain their food materials by feeding on other organisms. Those that eat live or freshly-killed material are known as consumers. Those that live on dead organic material are known as decomposers.

   (b) The earth is a contained unit with no input of new matter. In order for life to continue, matter must be recycled.

   (c) In nature, basic matter is cyclic although some cycles are infinite in length. Cycles important to living organisms include the water, carbon, nitrogen and mineral cycles.

   (d) Living things depend on bacteria in the soil to convert inorganic matter into usable sources of nitrogen.

   (e) The decomposers (microorganisms, fungi, yeast, bacteria) help recycle organic matter by breaking down dead material and by themselves being incorporated into the food web.

   (f) Because of specialization, there is a tendency toward maximum utilization of the environment.
   EX: Species tend to specialize through evolution because it allows them to exploit certain resources of their environment more efficiently and thus avoid competition with other species.

4. All organisms are interrelated with the non-living or physical part of the environment.

   (a) Living things interchange matter and energy with their environment.
   EX: Matter and energy are obtained from the environment through food consumption and are donated to the environment through: predation (serving as the prey); decay; waste production; and heat loss.

   (b) Organisms interact with each other in relationships other than food.
   EX: Plants may provide cover and nesting materials for animals. Animals may aid in dispersal of seeds.

   (c) Green plants produce oxygen which both plants and animals need for respiration.

   (d) The environment influences the behavior of an organism.

(B. contd.)

(e) The living environment influences the composition of the non-living.

(f) Soil on which plants are growing erodes much less than soil on which no plants are growing.
EX: This is because the roots of plants hold soil together.

(g) Many aspects of the quality of life depend upon the management and products of the soil.
EX: The nature of the soil is a product of type of bedrock, climate, and activity of organisms. The nature of the soil in part determines the productivity of the land.

(h) Trees (forests) aid in flood control.

(i) Because of his ability to think and manipulate, man has a greater effect on the environment than any other single kind of organism.

(j) Organisms are affected by their physical (non-living) as well as living surroundings.

(k) Because of adaptation to a particular place in the environment, each type of organism can only live within certain environment stress limits.

(l) Living organisms tolerate relatively narrow ranges of temperatures. Any change in temperature may be detrimental.
EX: Thermal pollution.

(m) Specific environments can only support a limited number of organisms of a particular kind. The maximum number supportable is the carrying capacity of that particular environment.

C. <u>The causes and effects of change must be considered</u>.

1. There are causes for changes in the environment.

(a) Organisms may affect their local environment so that it is no longer favorable for them to live there and other organisms may replace them.

(b) Research in ecology indicates that the addition or removal of a single species will result in a change of interrelationship within a community.

(c) Crowding of animals often leads to physiological changes, such as alterations in the function of adrenal, pancreas and other glands.

(d) Under crowded conditions, experimental animals often show psychotic behavior patterns.

(C. contd.)

2. Changes in the environment affect the organisms present.

(a) Organisms are continually adapting toward better utilization of their environment.
EX: They have adapted through evolutionary changes, the driving force behind these changes being the interaction of the organisms with the environment.

(b) All living things are influenced by changes in their environment.
EX: The environment is constantly changing. The ability of a species to survive is dependent upon its ability to adjust to these changes.

(c) The greater the reproductive potential of an organism, the faster evolution may proceed and thus the easier it is for that organism to meet changes in the environment.

(d) Species of organisms unable to adapt to changes in the environment become extinct or migrate.

(e) Communities with few numbers of species are much less stable than communities with larger numbers of species. The less diverse a community, the more it will be affected by environmental changes.
EX: In a cave ecosystem the removal of one species can destroy the whole ecosystem.

(f) Among animals, buildups of large populations may result in reduced reproductive activity, fewer young per litter, and decreased parental care which results in greater mortality of young individuals.

(g) Crowding of animals often leads to behavioral changes such as aggressive activity.

D. <u>Population size is regulated in nature</u>.

1. External factors regulate population size.

(a) Although reproductive potential is high, organisms generally do not increase greatly in numbers because of the effects of environmental factors.
EX: These are predation, disease, etc. Population size equals reproductive potential minus environmental resistance.

(b) Population increase or decrease may be calculated as the difference between birth rate and death rate.
EX: When birth rate is higher than death rate, population size increases. When birth rate is lower than death rate, population size decreases.

(D. contd.)

(c) Organisms invading new environments show typical population growth curves.

(d) S-shaped population growth curves start with a slow growth rate which increases to an extremely fast rate and then slows again as the population reaches the carrying capacity. Population size then varies around the carrying capacity level.

(e) J-shaped growth curves are similar to S-shaped curves but instead of leveling off near the carrying capacity, the population shoots way above it. The result is massive die-off due to such things as lack of food, lack of cover, epidemic diseases, etc.

(f) The number of plants and animals of a given species that can live together in a community is affected by biological as well as physical factors.

(g) Competition among living things exists whenever any life requirement is available in limited amounts.

(h) Predatory animals have an important role in a community.

(i) When population levels become too high, enough food is often not available. The result is usually food resource destruction followed by mass starvation.
EX: Overgrazing can destroy the food source.

(j) Predators and parasites are a necessary part of the whole system.
EX: They help provide the environmental resistance which keeps populations from reaching excessive levels. Predators usually kill only weak and diseased individuals and are thus a positive factor in the evolution of the prey species.

(k) The greater the specificity of the predator or parasite, the easier it is affected by changes in the population size of the most important prey or host species.

2. Internal factors regulate population size.

(a) The reproductive potential (the potential to increase in numbers) of most organisms is extremely high.

(b) Members of a population tend to establish territorial boundaries.
EX: This territorial boundary establishment results in each member of the population having an adequate supply of required materials and conditions with which to live and reproduce.

EX: This area over which a single organism moves is known as its home range.

(D. contd.)

EX: That portion of the home range which an individual defends against intruders of the same species is known as its territory.

(c) Territoriality is an inherited behavior pattern.

(d) Territoriality is one of the factors that may regulate population size.

(e) Although plants cannot actively defend a territory, many show spatial distributions influenced by secretion of substances which inhibit the growth of members of the same species close to them.

E. <u>The world is a finite system with limited resources</u>.

1. Human consumption is the use of natural resources.

(a) Natural resources are vital to man's existence.

(b) All material things used by people are dependent upon natural resources.

(c) Many wildlife populations are important economically, aesthetically, and biologically.

(d) An important use of wilderness and natural areas is for recreation.

(e) An aesthetically pleasing environment is important to the well-being of man.

2. These resources vary in respect to availability, distribution and renewability.

(a) Soil, in interaction with plants, is the primary source of our food, clothing, and shelter.

(b) The resources of an area include the abilities and services of its people engaged in maintaining and developing the basic resources.

(c) Most plants and animals are renewable resources.

(d) Managed harvesting makes it possible to maintain population size and insure continued harvesting.

(e) Minerals are nonrenewable resources.
EX: This resource supply is diminished through use because mineral cycles take such a long time (millions of years).

(E. contd.)

(f) Natural resources are unequally distributed in the land areas.

(g) In environments where resources are limited, there tends to be fewer numbers of species and relatively larger numbers of individuals per species than in more favorable environments.

(h) The distribution of knowledge and technology parallels material resources in that they are unequally distributed.

(i) Coastal areas are the most productive areas of the oceans.

(j) Wetlands (estuaries, inlets, and marshlands) are breeding places for most marine life.
EX: These areas are rich in nutrients.

EX: Shallow depths of ocean water receive more light energy from the sun; therefore, coastal areas are more productive to life.

II.

PROBLEMS

A. The environment is contaminated (pollution).

1. Water is polluted.

(a) Damming of streams changes the environment, the community and its inhabitants.
EX: The resulting warmer bodies of water have less oxygen and in such cases, cold water sport fish often are replaced by other types of warm water fish.

(b) Unless special arrangements are made, damming of streams prevents upstream movements of fish and is often injurious to fish that live in the oceans but swim upstream in fresh water to breed (anadromous fish).

(c) Water does not respect political boundaries. Water pollution and water uses must be controlled on a regional, national or international basis.

(d) Dumping organic wastes into water increases microbial activity which results in a decrease in the oxygen content of the water (B.O.D.).

(e) Phosphates in detergents eventually enter bodies of water where they promote heavy algal blooms and lead to accelerated eutrophication (filling in).

(f) Many materials dumped on soils (pesticides and fertilizers) usually wind up in water where they cause contamination and eutrophication.

(g) Dumping of wastes in the oceans occurs in coastal areas, thus affecting the most productive regions.

(h) Improper disposal of human excrement is a common cause of water pollution.

(i) Typhoid fever, dysentery, cholera and hepatitis are diseases often spread by polluted water.

2. Air is polluted.

(a) Metallic pollution of water and air destroys certain food sources and may cause cancer and nervous system disorders.

(b) Air pollution irritates the air passages in organisms and increases deaths from such diseases as pneumonia, bronchitis, asthma and emphysema.

(A. contd.)

(c) Atmospheric pollution changes levels of gases in the atmosphere which in turn affect solar radiation absorption and loss of heat by reradiation.
EX: This may ultimately cause changes in climate and subsequently sea levels (greenhouse effect).

3. Land is polluted.

(a) Litter costs local governments large sums of money, lowers property values, mars the scenic beauty, and can be a health hazard.

(b) The amount of solid waste per person is increasing.

(c) Present waste disposal methods are inadequate, occupy land areas, and pollute other parts of the environment.

4. The environment in general is polluted.

(a) Pollution is not limited to material waste. Temperature and noise can be pollutants. There can also be visual (aesthetic) pollution.

(b) No means of energy (electricity) production is free of causing environmental pollution.

(c) The genetics of an organism may be changed by changes in environmental factors.
EX: Radioactivity.

(d) Many pesticides tend to accumulate in fatty tissue. They are concentrated with each step in the food chain.
EX: Thus effects may be felt more by large predators than by the pests for which they were intended.

(e) Natural pest control (biological) is less injurious to the environment and man than chemical pest control.
EX: Since most pests are small, have high reproductive potential and short generation times, they rapidly evolve resistance to pesticides. Man cannot because of his longer generation time. The long-range effects of pesticide are more harmful to man than to the pests for which they were intended.

B. <u>Population growth is uncontrolled</u>.

1. There is a lack of awareness of the effects of overpopulation on the environment.

(a) The carrying capacity of the earth for people is limited.

(B. contd.)

(b) We can ease pollution and ecological problems but we cannot solve them without first solving population problems.

(c) Increasing human populations, rising levels of living, and resultant demands for greater industrial and agricultural productivity promotes increasing environmental contamination.

(d) Growth in population increases use of water in homes and industry, diminishing the amount of available water.

(e) Man's need for food, fiber, and minerals increases as populations expand and levels of consumption rise.

(f) Increasing population and per capita use of resources is changing land-to-man or resource-to-population ratios.

(g) As population increases, competition for resources increases causing social problems.

(h) As populations increase and resources decrease, the freedom of the individual to use the resources as he wishes decreases.

(i) Buildups of extremely large populations increase the possibility of epidemic diseases.
EX: Because of increased frequency of contacts, disease organisms can spread much faster. It is easier for them to find a proper host in crowded situations than in uncrowded situations.

(j) Crowding of humans can cause an increase in mental stress and tension.

(k) Increases in crime, drug abuse and alcohol abuse parallel increase in population size and crowding.

2. There is a lack of widespread dissemination of family planning information.

(a) The inevitable ramifications of overpopulation are not widely recognized.

(b) Widespread implementation of family planning information is impeded by religious and cultural beliefs.

(c) An expanding economy has been linked traditionally with an expanding population.

C. Resources are mismanaged.

1. Resources are not used efficiently.

   (a) Fur and skin-bearing animals are slaughtered only because the public provides a market. Without such demands, wildlife populations might not be destroyed.

   (b) Covering natural land with concrete results in a decreased potential supply of food and oxygen.

   (c) In many cases, man has simplified community structure by reducing the number of species present (reducing diversity). Such "man-made" communities are more vulnerable to natural disasters than the original communities that were present.

   (d) Man has hastened the extinction of certain animal species by exploitation.

   (e) Non-renewable resources are not conserved.

2. There is a lack of respect for future needs.

   (a) Man currently is jeopardizing the future survival of the race through the measures he employs in improving his standard of living.

   (b) Many of the problems of the world today are due to our mismanagement of the environment.

   (c) Nations and civilizations can collapse and disappear through misuse and depletion of their natural resources.

   (d) Competition for scarce resources necessitates the establishment of priorities.

   (e) Since resources are limited, man must recycle the products of his technology or he will exhaust his natural resource supply.

   (f) Environmental options available to future generations must not be foreclosed.

3. There is a lack of consideration for the economic value of the environment.

   (a) Damage to the environment is not considered as having a monetary value when costs are being calculated for projects.

(C. contd.)

(b) Immediate economic efficiency accelerates the depletion of natural resources.

(c) Excessive market demands generally override good management policies.
EX: This can endanger species, deplete resources, and change ecosystems.

(d) Individuals, corporations, etc., tend to select short-term economic gains over long-term environmental benefits.

(e) Poor management of a natural resource can be an immediate economic gain but will eventually be a liability to future generations.

(f) Scarcity of natural resources has been a basic cause of conflicts between people, both as individuals and as nations.

4. Wildlife and natural areas need to be preserved.

(a) Physical well-being is a fundamental necessity for survival even though man often places a higher value on other things.

(b) Availability of natural environments may be necessary for good mental health.
EX: Man's origins lie in natural environments. Existence in man-made environments produces stress.

(c) Aesthetic resources and recreational facilities are becoming increasingly important as leisure time increases.

(d) Man is destroying the natural habitats of many wild species.

(e) Extinction of species is more often caused by destruction of natural habitat than by the killing of individual animals or plants.

(f) Game can be overprotected. Removal of predators may result in overpopulation that can lead to damage of the habitat and actual reduction of game populations.

5. There is insufficient land use regulation.

(a) Conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.

(b) Urban sprawl, and other consequences of insufficient land use regulation, contribute to a decline in the quality of the environment.

D. Roadblocks prevent the implementation of available technological solutions.

1. Cultural and social roadblocks prevent implementation.

(a) A community has its customs, traditions, values and beliefs rooted in the past of the individuals and groups which compose it.

(b) Many of the customs, traditions, values and beliefs of a community affect the use of natural resources.
EX: In the United States, while our frontier was being established, most individuals believed that natural resources were bountiful and conservation measures were unnecessary.

(c) Many individuals become apathetic regarding the use of natural resources when they are not taught the adverse effects of their misuse and mismanagement.

(d) Many individuals believe that environmental problems are caused by someone else and they should have no part in correcting them.

(e) Many individuals feel that they are a small part of a great mass of people and can do little to overcome environmental problems.

(f) Mobility of population affects the demand on natural resources.
EX: As people become more mobile, there is an increased demand for resources such as oil, rubber, iron and steel, which are necessary for transportation.

(g) The socio-economic status of individuals affects the demand on natural resources and resource management.
EX: The higher the economic standard of living, the greater the demand on natural resources.

(h) A cultural and time lag exists between the development of knowledge in science and technology and application of that knowledge to resource and environmental problems.

2. Economic and industrial roadblocks prevent implementation.

(a) Natural resources have an economic value as long as they are potentially useful, whether directly or indirectly, for human consumption.

(D. contd.)

(b) As a community becomes more developed, there is an increased demand on natural resources and an increase in their economic value.

(c) Individuals and industries often use resources and dispose of wastes as if the environment had no economic value.

(d) Whenever individuals or industries deplete the land of natural resources, they often fail to restore it.
EX: Strip mines leave the land unsightly and deplete its economic value.

3. Political roadblocks prevent implementation.

(a) Government at the national, state, and local levels has the supreme authority for directing resource management and/or settling disputes concerning resource management.

(b) Totalitarian governments generally have highly centralized control over resource-use management and are not affected by political pressure groups in their decision-making process.

(c) Democratic governments are often affected by political pressure groups in their decision-making process.

(d) Political pressure groups differ greatly in their emphasis on the utilization of natural resources.
EX: Some are petitioning for conservation of natural resources, while others are lobbying for increased resource use in the name of progress.

(e) Too often government has responded to pressure groups who desire widespread use of natural resources in the name of progress.

(f) Too often courts have interpreted human rights in ways which condone the misuse of natural resources.
EX: It is often believed that a man has a right to do what he pleases with his property. Should one deplete the natural cover of his land, soil erosion problems may arise which affect the natural resources on other people's property and even threaten their lives.

(g) An extremely large population not only depletes natural resources but also makes a democratic way of government more difficult and leads to increased domestic and international conflict.

III.

SOLUTIONS AND OBJECTIVES

A. Technical solutions and/or controls are available to solve (or at least lessen) the problem of environmental contamination (pollution).

1. Water pollution can be controlled.

   (a) There are procedures for processing contaminated water, such as filtration and chlorination.

   (b) Adequate regulation of soil erosion and the dumping of wastes into water must be enforced.

   (c) Adequate regulation of phosphates, pesticides and other chemicals must be enforced.

2. Air pollution can be controlled.

   (a) Adequate regulations for the discharge of pollutants into the air that are irreversible in nature must be enforced.

   (b) More effective controls of industrial pollutants must be developed and enforced.

   (c) Alternative power systems which emit much fewer pollutants must be developed.

3. Land use can be managed.

   (a) A land ethic must be developed, defining man's responsibilities to his environment.

   (b) The amount of solid wastes must be reduced to a minimum and those wastes must be recycled.

4. Pollution of the environment in general can be reduced.

   (a) The detrimental effects of pest control may more than offset any benefits.
   EX: Before a pest control program is initiated, careful consideration should be given to the overall effect on the environment.

   (b) Biological control of pests is ecologically more desirable than chemical control.
   EX: Natural pest control is less likely to upset ecological balances and less likely to be harmful to man.

(A. cont'd.)

(c) Over a long period of time natural pest control can be more successful than chemical pest control. The high reproductive potential of most pests allows them to rapidly evolve pesticide resistance.

(d) Thermal pollution and other adverse effects of radioactivity must be controlled.

(e) Noise pollution and visual pollution must be controlled and regulated.

B. Population growth must be controlled.

1. Develop a public awareness of the effects of overpopulation on the environment.

(a) In order to reverse current population trends, couples should consider limiting the number of offspring per family.

(b) Mass media programs on the effects of overpopulation on the environment must be increased.

2. Family planning information should be made available to everyone.

(a) It is more humane to lower the human birth rate than to perpetuate conditions which will eventually increase death rate.

(b) Family planning and the limiting of family size are important if overpopulation is to be avoided and a reasonable standard of living assured for successive generations.

(c) A special effort must be made to provide family planning information to individuals of low socio-economic status.

C. Resources can be managed efficiently.

1. Manage the harvesting of renewable resources.

(a) Conservation includes the managed harvesting of renewable resources.

(b) Renewable resources must be used efficiently to effectively conserve them.

(c) If man changes his consumption patterns to utilize more organisms at the base of the food pyramid (producers) and utilize fewer organisms at higher levels (consumers), he will increase the amount of food available to him.

(C. contd.)

EX: As a consequence of inefficient energy transfer, each level (primary consumer, secondary consumer, etc.) has a smaller total biomass than the level below it. For example, 100 pounds of producers may support only 10 pounds of primary consumers which may support only one pound of secondary consumers. The result is a "food pyramid."

(d) Non-renewable resources can be conserved through recycling.

(e) Recycling will reduce the solid waste disposal problem.

2. Evaluate the use of resources in terms of both present and future needs.

(a) Review of past environmental experiences will often help us to avoid mistakes in the future.

(b) If we are to live in a quality environment, energy flow must be diverted from growth to maintenance.

(c) Projects affecting the environment need to be scrutinized carefully because the effects may be irreversible.

(d) The management of natural resources requires long-range planning.

(e) Man, in his self-interest, must manage soil, water, forests, and wildlife. Management may also mean not using some resources.

3. Consider the economic value of the environment.

(a) Monetary value of damage to the environment must be included when considering costs of projects.

(b) Industry must be held economically accountable for waste products as well as profitable products.

(c) Individuals must be held economically accountable for their waste products.

4. Respect wildlife and natural areas as being useful and necessary.

(a) Introduction of exotic animals and plants should be investigated carefully before action is taken. If they are successful, they often displace native organisms and become pests.

(b) Hunting regulations are useful in maintaining and restoring populations as well as in distributing the game harvest.

(C. contd.)

(c) Bag and creel limits are not ends to be achieved in hunting and fishing but only limits beyond which no one should go.

(d) Individuals visiting wilderness areas should leave them undisturbed so that they can be enjoyed at future dates and by other people.

5. Regulate land use with consideration for both man and the environment.

(a) Zoning is a practice in which land use should be based upon the most effective way the land can serve the needs of people.

(b) Man's psychological needs should be considered in regulations for land use and development.

(c) Community planning can result not only in technical efficiency but also in aesthetically pleasant surroundings. Both results are important if a community is to function smoothly.

(d) Multiple use is a practice in which a given land area functions in two or more compatible ways. Use of land for two compatible functions usually results in greater benefit to man than use for only one function. Total productivity is greater.

D. Roadblocks can be removed.

1. Individuals must develop an awareness of their environment and assume a personal responsibility for the development of a healthy environment (cultural and social).

(a) Individuals must become more aware of the role of the environment in human life and develop respect for natural resources.

(b) Individuals must develop confidence to make judgments about their environment and provide criteria and experiences upon which to base these judgments.

(c) Individuals must assume a personal responsibility for the development of a healthy environment.

(d) Individuals must develop life styles which will enhance respect for the environment and support life in an increasingly technological and man-made world.
EX: They must treat natural resources with the attitude that they are stewards not owners of them and be willing to make sacrifices to protect the environment.

(D. contd.)

EX: They must engage in wise conservation practices in their home and business life and support conservation programs of private organizations and the government.

(e) Individuals must develop a new concept of human progress, a concept based upon quality of the environment for all, not just on an expanding economy or on the massing of material goods by a few at the expense of the majority.

(f) In order to improve environmental literacy and motivate individuals to assume responsibility for the development of a healthy environment, including a change in their life styles, environmental education programs must be increased in number and existing ones must be strengthened.

EX: Mass media programs on conservation must be increased.

EX: Environmental education programs in schools at all levels must be improved and increased in number.

EX: Values regarding the environment can be clarified by using scientific methods of inquiry.

(g) Unless conservation measures can be effectively implemented, widespread popular practices, such as long vacation trips or the eating of luxury foods, may have to be curtailed.

2. Economic values must be assigned to environmental resources, when decisions on the economic feasibility of an action involving the environment are to be made (economic and industrial).

(a) Man has the technology to solve present environmental problems but he often fails to use it, generally because it seems too costly.

(b) Businesses and individuals can be pressured into using the technology available to solve environmental problems by:

(1) public opinion
(2) educational programs
(3) consumer purchasing policies
(4) government regulation.

(c) Individuals and businesses must be required to restore land which they deplete.

(d) We all may have to curtail our spending for luxury goods in order to conserve our natural resources.

(D. contd.)

3. Procedures must be defined for changing government policy, attitudes, rules, regulations and laws, accompanied by a strict enforcement policy (political).

   (a) Procedures must be developed concerning the best methods of ensuring that government at all levels will be responsible for strictly regulating the management of natural resources and conducting environmental education programs.
   EX: Guidelines must be established to direct governmental decision-making regarding the environment and insure that governments will not favor private interest groups over the welfare of the majority.

   EX: The government's natural resource policy must be reevaluated continuously in terms of its effect on the public interest and in light of scientific knowledge about natural resources.

   EX: Environmental impact studies should be compiled and used as a basis for decisions.

   (b) In a nation having a democratic form of government, a sound governmental conservation policy can be implemented after massive public opinion is aroused and individuals are willing to make financial and other sacrifices necessary for the implementation of such a policy.

   (c) A new concept of individual rights must be implemented to protect the environment, whereby a person is not permitted to use his property in such a manner that the environment and other people will suffer.
   EX: Government policy should prohibit a person from depleting the natural cover to his land without restoring it.

   (d) In order to safeguard democracy and reduce domestic and international conflict as well as enhance the quality of life, population control programs are necessary.

   (e) As competition for scarce natural resources continues, establishment of priorities by governments will become necessary.

G L O S S A R Y

ABIOTIC - Non-living.

ADAPTATION - An organism's ability to adjust to changes of the environment.

BACTERIA - One-celled organisms.

BIOMASS - Living weight per unit area.

BIOME - A large land community, the complexion of which is determined by climate, soil and vegetation. We speak of a desert, or arctic tundra or tropical rainforest as biomes. Each supports only those species of flora and fauna that are adaptable to the existing conditions.

B.O.D. (BIOLOGICAL OXYGEN DEMAND) - Amount of oxygen needed to support organisms and materials in a body of water. This demand increases tremendously when pollutants are added.

CARRYING CAPACITY - The limit of an environment's ability to support life without breaking down.

CHEMICAL BONDS - The forces holding atoms together in a compound. Energy can be taken up when the bonds are made, and given off when they are broken (the process is reversible).

CLIMAX - A stage reached by a plant community where it will maintain itself without change over an indefinite period.

COMMUNITY - All the living organisms within a given environment, each of which exerts an influence--sometimes obvious, sometimes not--over each of the others.

COMPETITION - The natural struggle among living organisms (even among cells in your body) for the necessities of life.

CONSERVATION - The preservation and efficient use of natural resources.

CONSUMERS - Organisms in the producer-consumer-decomposer matter cycle which need other organisms for food.

DECOMPOSERS - Organisms that decay or break down organic matter into simpler substances through the process of decay.

ECOLOGY - Coined from the Greek oikos and logos and translated "study of the home." It is the study of the interrelationships of all living and non-living things.

ECOSYSTEM - Any area or system in which living organisms and non-living substances interact to produce an exchange of materials. A self-renewing community populated by producers, consumers, decomposers, and abiotic materials.

ENERGY - The capacity for doing work.

ENVIRONMENT - The sum total of all factors, living and non-living, that influences an organism.

ESTUARY - An inlet where salt water joins fresh water.

EUTROPHICATION - A natural process of succession of a body of water. As plants and animals die, the water is gradually filled in, eventually becoming land.

EVOLUTION - That process of natural and continuing change by which organisms slowly adapt themselves to changing conditions.

EXOTIC - A plant or animal introduced to an environment it had not previously inhabited.

FOOD CHAIN - The transfer of energy as organisms feed one upon another.

FOOD PYRAMID - A quantitative representation of a food chain with producers forming the base and carnivores at the top. As a consequence of inefficient energy transfer, each level of consumer has a smaller total biomass than the level below it.

FOOD WEB - An interlocking of food chains.

HABITAT - That limited area where a plant or animal can find the exact conditions necessary to sustain life.

NATURAL (BIOLOGICAL) PEST CONTROL - Control of pests without the use of industrially manufactured compounds.

NATURAL RESOURCES - The basic materials needed to sustain life.

NICHE - Location, function, life style, and food preference suitable to an organism.

ORGANIC - Noting or pertaining to a class of compounds that formerly comprised only those existing in or derived from plants or animals, but that now includes all other compounds of carbon.

ORGANISM - Any form of animal or plant life.

PRODUCER - Organisms (chiefly green plants) that can convert solar energy and abiotic materials into food for all other living things.

RECYCLING - Using materials over and over again so that little waste is left over to accumulate.

SPECIES - Groups of individuals having common characteristics and the ability to reproduce only with their own species.

SUCCESSION - An orderly and progressive replacement of one community by another until a relatively stable (climax) community is reached.

TERRITORIALITY - Claiming of a specific territory by animals for the purpose of securing food and shelter.

THERMAL POLLUTION - Contamination of a body of water by change of temperature.

WATER CYCLE - The continuous cyclic movement of water from the earth to the atmosphere and from the atmosphere to the earth.